

# Using a frailty model to evaluate risk factors for atopic dermatitis among insured Swedish dogs

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## Introduction

- Canine Atopic Dermatitis (CAD) is an allergic skin disease in dogs
- The incidence of CAD has a strong genetic component and varies between breeds (Figure 1)
- Environmental risk factors are important in the epidemiology of human atopy
- The effect of breed should be accounted for when evaluating other risk factors for CAD
- Survival models with a random error term are called frailty models
- Each breed can be considered a group with shared frailty

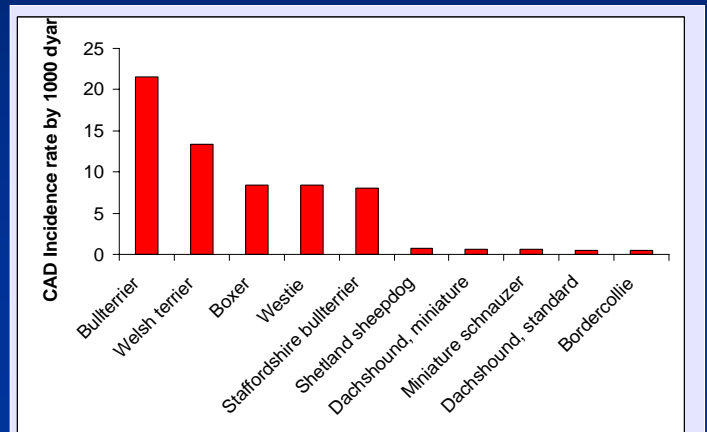


Figure 1. Incidence rate of CAD by 1000 dog years at risk (dyar) for five high-risk and five low-risk breeds among insured Swedish dogs.

## Materials and methods

### Dataset

- Around 220 000 Swedish dogs insured by "Agria" between 1995 and 2002, 130 different breeds
- 1215 animals with reimbursed insurance-claim for CAD



### Analysis

- Cox proportional hazards model applied, shared frailty by breed (gamma-distributed)
- Software package: Stata 8

Table 1. Hazard ratios, standard errors and p-values from a Cox proportional hazards model of CAD with shared frailty for breed.

Variable		Hazard ratio	Std error	P-value
Region	North	<i>Baseline</i>		<0.001*
	Central	2.67	0.44	<0.001
	South	3.13	0.52	<0.001
Habitat	Other	<i>Baseline</i>		<0.001
	Urban	1.57	0.10	<0.001
Season	Winter	<i>Baseline</i>		<0.001*
	Spring	0.96	0.07	0.611
	Summer	0.94	0.08	0.490
	Fall	1.31	0.11	0.001
Birth-year	9 Categories			<0.001*

\*p-value for overall likelihood ratio (LR) test of categorical variables

## Results

- Significant frailty effect
  - $\Theta = 0.97$
  - LR test of  $\theta = 0$  ( $p < 0.001$ )
- Model fit considered adequate
- Several risk factors for CAD identified (Table 1):
  - Urban habitat, living in central or Southern Sweden, being born in fall
  - Increasing hazard by birth-cohort (95 – 00)

## Discussion

- Alternative strategies for including breed
  - Fixed effects
  - Robust variance estimator